The Copernicus Journal of Political Studies 2019
No. 2/2019, pp. 157–180
ISSN 2299-4335
DOI: http://dx.doi.org/10.12775/CJPS.2019.0017
www.apcz.umk.pl/czasopisma/index.php/CJPS

CJPS

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# THEORETICAL PREMISES OF THE IMPACT OF ARTIFICIAL INTELLIGENCE ON INTERNATIONAL RELATIONS AND SECURITY

## ABSTRACT

The article presents the role of Artificial Intelligence technology in shaping security on the international dimension. This particular technology serves as an example of modern technological innovation that could have a transformational effect on international relations by altering the capabilities of states (in Waltz's terms) and thus the balance of power in the international system. The argumentation is divided into three sections, the first focuses on a role that technological factor plays in the theory of IR. The second discusses the specifics of how artificial intelligence technology works and elaborates on four features of this technology that are key from an international security perspective. The third section introduces a theoretical concept of Charles Weiss for rendering interactions between technology and the international system and uses this distinction to elaborate on the question of how AI may influence international relations in the future.

## Key words

Artificial Intelligence, AI, international security, international relations, power of states, modern technologies

The paper addresses three problems from the domain of International Relations and phrases them as questions. The first general question, focused on the theoretical aspect of the issue, is how technological innovations impact international relations. The second question is aimed specifically at the technology of Artificial Intelligence (AI) – why AI may impact international relations on state and systemic levels. The last question is how AI may influence international relations. To answer these questions, the argument will proceed in three complementary stages. The first part of the paper introduces the role of technological factor in IR theory by referring to examples from the main paradigms (realism, idealism, and constructivism); it also presents a theoretical model of interactions between international relations and technological innovations developed by Charles Weiss (Weiss, 2005, pp. 295–313; Weiss, 2015, pp. 411–430). The second part consists of a short introduction to AI technology and a description of its four main traits significant for international relations. To better understand the specifics of AI, the reasoning in this part references a variety of scholars from the broad spectrum of IR and security studies. The final part concludes the argument and combines the information from two previous parts by embedding the traits of this technology in Weiss' theoretical model.

The best way to tackle the multidimensional problem of the importance of AI technology for international relations is to adopt the analytical eclecticism defined by Ruda Sil and Peter J. Katzenstein as an "approach that seeks to extricate, translate, and selectively integrate analytic elements – concepts, logics, mechanisms, and interpretations – of theories or narratives that have been developed within separate paradigms but that address related aspects of substantive problems that have both scholarly and practical significance" (Sil & Katzenstein, 2010, p. 10). As coherent with the eclectic approach, the quantitative approach including critical analysis of literature sources with elements of desk research methods was used to address the three focal questions of this study.

## Introduction

As stated by Klaus Schwab (Schwab, 2016, p. 2), the current international system is transitioning into a new stage called the Fourth Industrial Revolution, "fundamentally changing the way we live, work, and relate to one another. In its scale, scope and complexity [it] is unlike anything humankind has experienced before". This fundamental change will be possible mainly due to new technological innovations, as they are fundamental for economic development and military power, which in turn are essential ingredients of national power. Especially AI is indicated as one of the most crucial technologies in shaping the future international balance of power; as authors from the UK's Ministry of Defence stated in their Global Strategic Trends report, "it is plausible that by 2050 (or perhaps before) automation and artificial intelligence will have altered not just the character, but very nature of war" (UK MoD, 2018, p. 144). For Christopher Coker, AI may be so important that it should be included by IR scholars into their scientific considerations. In the paper in honor of Kenneth N. Waltz, Coker implied that on the level of individuals, in the future the importance of human agency will wane and the role of non-human agents is bound to amplify. He provokingly asked: "Should we see Artificial Intelligence as a Fourth Image to use Waltz'a methodology?" (Coker, 2018, p. 20) Unfortunately, no unequivocal answer to the above question was provided; however, the issue of AI importance for contemporary and future international relations was raised, a critical remark by K. Waltz that "in shaping the behavior of nations, the perennial forces of politics are more important that the new military technology" notwithstanding (Waltz, 1979, p. 173).

## 1. *How* do technological innovations impact international relations?

The technological factor is almost universally considered to be an essential element in explaining the political process. This fact can be well expressed in the words of Wiebe E. Bijker: "technology is vital for people, the planet and for creating profit, it is also important for politicians and politics, for this reason, is relevant to political science" (Bijker, 2006, p. 682). The booming technological progress currently observed is, according to Bolesław Balcerowicz, one of the critical development megatrends shaping the international system; its importance (difficult to overestimate) is due to the fact that it is a sine qua non condition of globalization in its current setting (Balcerowicz, 2012, pp. 62–65).

However, the importance of the technological factor is particularly evident in the area of security studies. According to Ryszard Zięba, in the understanding of security by participants of international life and in the functioning of countries and international system, the primary importance is attributed to the scientific and technical revolution because "permanent scientific and technical progress is primarily used in military technology and serves the construction of increasingly destructive and effective types of weapons" (Zięba, 2004, pp. 30–32). Each of the leading paradigms of security description in the field of international relations[1] takes into account in their explanations the role of the technological factor.

Of course, the importance of technological innovations is not only a result of recent advances – the historical examples are countless, ranging from pike to sailing ship, gunpowder, railroad, and combustion engine to nuclear weapons and machine learning (see Cipolla, 1965; Gilpin, 1981 pp. 56–59; Headrick, 1981; Jervis, 1989; Kosal, 2020; McCarthy, 2015; McNeill, 1988). The significance of the technological factor in international relations is not disproved by IR scholars. On the contrary, as Geoffrey L. Herrera critically noted, technological innovation is admittedly present in theories of international relations, and "technology looms across disciplines as a source of social, economic, and/or political change. It is often the master variable that explains everything" (Herrera, 2006, p. 3). Herrera identified two approaches to considering the role of a technological factor in IR literature (Herrera, 2003, pp. 559, 562–563). The first perceives technology as a central factor for international relations, but its operation is considered ad hoc – providing an ad hoc explanation of a given situation or change (e.g. taking into account the impact of nuclear weapons and their means of delivery; see Brodie, 1946), or the impact of telecommunications technologies on the growing interdependence (Keohane & Nye, 2012). The second approach also assigns central importance to technology; however, its impact is not direct and is a determinant of economic growth and thus indirectly of the distribution of potential and power in the international system (Gilpin, 1981). Describing the role of a technological factor in all paradigms exceeds the capacity of this paper, but for the sake of argumentation, the author will signal the role ascribed to technological innovation in three paradigms ((neo-)realism, (neo-)liberalism and constructivism).

Hans Morgenthau, the nestor of realism, wrote that "the fate of nations and civilizations has often been determined by a differential in the technology of warfare for which the inferior side was unable to compensate in other ways" (Morgenhtau, 1997, p. 139). For him, new military technologies (nuclear weapons in particular) were responsible for transforming the bipolar system with easily defined great powers into a multipolar system with more actors empowered by military technologies (Little, 2004, p. 155). Waltz's words quoted earlier should be treated as an exception rather than a rule, as the founding father of structural

[1] In this context, Ryszard Zięba points to three main paradigms – realistic, liberal and constructivist (Zięba, 2017, pp. 13–26).

realism generally recognized the role that technology plays in shaping the capabilities of the states and thus indirectly the structure of the international system. In his late writings, he admitted that "realist theory, old and new alike, draws attention to the crucial role of military technology and strategy among the forces that fix the fate of states and their systems" (Waltz, 1998, pp. 48–49). The last but not least representative of (neo-)realism, Robert Gilpin indicated that technology was the main factor (alongside with differential growth in power among states) responsible for systemic disequilibrium: "a military or technological innovation may dramatically reduce the cost and increase the benefits of territorial conquest and thereby encourage military expansion" (Gilpin, 1981, p. 22). Briefly speaking, realists consider technology as an independent variable affecting the economic and military potential of a state, and thus co-responsible for a systemic change.

Neoliberals, on the other hand, approach the role of technological innovations (especially information technologies) more optimistically as a fundamental source of economic globalization, essential for the creation of new international institutions (also nonstate actors) and a condition for increasing interdependence (Keohane & Nye, 2012, pp. 211–223). Technological innovations (along with ideational factors) are also the main force that drives change in the international system (Nye, 201, p. 32). Alexander Wendt, here chosen as a representative of constructivist paradigm (which was labelled by Knud Jørgensen as the constructivist liberal theory of international cooperation (Jørgensen, 2018, p. 104)) perceives technological factor as a part of structural forces (an important material constrain) limiting states in their actions and shaping their identity (Wendt, 1999, pp. 110–111, 358–359). In particular, the importance of military technologies (offensive or defensive) in international relations results from ideas, interests and roles (enmity or friendship) they engender and help to support. Wendt shows that physical artifacts acquire meaning only inside the process of defining foes and friends by the states: "Five hundred British nuclear weapons are less threatening to the US than five North Korean ones because of the shared understandings that underpin them. What gives meaning to the forces of destruction are the 'relations of destruction' in which they are embedded: the shared ideas, whether cooperative or conflictual, that structure violence between states. These ideas constitute the roles or terms of individuality through which states interact" (Wendt, 1999, p. 255).

The realists perceive technology as an independent variable that is crucial for building national power and state capacity; for liberals, it is a key enabler of economic growth and the force fuelling interdependence that connects actors in the international system; the constructivists interpret technology as a context-driven variable which exerts structural pressure on states and simultaneously is shaped by social forces.

The impact of technological innovation on international relations is multidimensional and, among others, enables people to take actions that were previously impossible. This process is intensified by technology diffusion and competition in the technological area as well as different capacity of states to implement technological innovations (Gałganek, 2011, p. 15). As previously electricity, railway, and telecommunications as well as nuclear weapons, AI is an example of large technical systems, "spatially extended and functionally integrated socio-technical networks" (Renate & Hughes, 1988, p. 5) that are able to change patterns of interaction within the international system and thus change the structure of that system itself. Such technologies are defined by G. L. Herrera as systemic technology; they cannot be reduced to being a feature of a single subject of international relations and exert influence on the time and space in which the relations of entities forming the international system take place. At the same time, it mainly pertains to relationships that are both physical and related to mutual communication and the ability to cause harm (Herrera, 2006, p. 26). AI is a perfect example of next-generation technological innovations that may be called a systemic technology, so before addressing the question of how AI may influence international relations, the issue of the technology itself must be addressed first.

## 2. *Why* may AI impact international relations?[2]

First, a reference must be made to distinctions useful in capturing the specifics of AI technology – the notions of automatism, autonomy, intelligence, artificial intelligence, and a robot. The most extensive category is the concept of automatism, i.e. the ability of a system to repeatedly perform human-planned activities in a non-changing environment with minimal or no human interference (e.g. manipulators that assemble parts in car factories). This category includes the other four concepts – autonomy, intelligence, AI and robot (Hoadley & Lucas, 2018, pp. 1–4). Autonomy is a gradual concept meaning the ability to receive stimuli from the environment, to plan and to implement previously made decisions to complete the assumed task. Intelligence is "the ability to understand, learn and

[2] The following argument does not, of course, exhaust the subject of AI as it is only intended as an introduction to facilitate understanding of the features of the described technology, nor is its purpose to delve into technical issues related to the creation of AI.

use our knowledge and skills in new situations" (Inteligencja, n.d.). There is no single definition of AI commonly accepted by the scientific community. Jacob Turner concluded the review of the AI definition by indicating that "artificial intelligence is the ability of a non-natural entity to evaluate and make choices" (Turner, 2018, p. 16)[3], with the use of the word "inanimate"[4] as opposed to "created by man" (man-made) to emphasize the fact that AI is able to autonomously, without human intervention, improve its own code so as to e.g. create another AI. AI is further divided into so-called narrow, weak AI and general, strong AI. The first term applies to (IT) systems with a sole, specific objective, e.g. speech recognition or driving. General AI, on the other hand, means an (IT) system capable of performing many tasks, even of setting goals for itself while the system works without human intervention. Currently, none of the existing solutions can be described as such. Narrow and strong AI create a particular spectrum of possibilities and with the passage of time and the progress of technology, as well as the due to the process of self-learning and improvement, AI systems will resemble weak AI less and will become more like general AI. It should be noted, however, that the very possibility of creating a general AI is often contested in science. The last of these concepts is a robot, i.e. a physically existing machine, built according to the logic of "recognize-think-act", which must have all three elements: sensors (for recognizing the environment), a computing center (equipped with AI) and effectors (enabling interacting with the environment) (Singer, 2009, p. 67). In addition, a robot can be an automatic or autonomous system; each autonomous system must contain AI.

The main objective of developing the technology of artificial intelligence is to translate the humans' way of collecting and processing information in their minds into a way that will enable a machine to perform mapping processing as an independent, autonomous action that is a necessary element of the ability to learn. Until recently, what was dominant in the case of AI[5] was the so-called

[3] "Artificial Intelligence Is the Ability of a Non-natural Entity to Make Choices by an Evaluative Process".

[4] In this context, the notion of an actor follows the one used by the co-creator of Theory of Network Actor Bruno Latour, who indicates that in order to understand the relations prevailing in a society it is necessary to consider both human actors and inanimate actors. "An actor means everything that works, an actor is everything that is the source of action". (Latour, 1992, p. 256).

[5] Margaret Boden defines this type as Good Old-Fashion AI; in addition to the self-learning approach using neural networks, she distinguishes also evolutionary programming, cellular automata, and creating dynamic systems. (Boden, 2016, p. 6).

"symbolic" approach, consisting of programming the machine by providing it with all the necessary information that it should possess to be able to perform a given action. An illustration of this use was the 1997 victory of the IBM-created computer and software system Deep Blue over the chess grandmaster Garry Kasparov; its operation was based on the use of high computing power to analyze possible moves and choose the optimal one. Today, the goal is to allow the machine to learn "independently" how to perform the operation called machine learning[6]. The revolutionary character of the changes described above was encapsulated by the *Wired* magazine in the slogan that the era of coding (writing program code for computers) is ending, and the era of machine learning is coming (Tanz, 2016). The idea is to use the capabilities of the machine to collect knowledge[7] coming from its own experience in order to better perform a given activity; what is more, this technology enables the machine to learn in situations of incomplete knowledge. This approach to learning machines typically uses a model[8] of artificial neural network[9]. The so-called deep learning involves transmission of information through multiple layers of neural[10]

[6] However, this is not the only way to create AI today. For example, the Libratus program, which in 2017 learned to "play" poker and defeated four professional players at this game, does not use machine learning method, but the modernized counterfactual regret minimization (CFR) method, which allows the program to analyse not only possible moves, but also weaknesses in its own strategy. Other methods of creating AI include the use of evolutionary programming, genetic algorithms, computational game theory, Bayesian estimation, and fuzzy logic (Hsu, 2017).

[7] The data that the machine receives can be described (labelled), non-described (unlabelled) or the result of interaction with the environment.

[8] Ryszard Tadeusiewicz points to three main types of neural networks: multilayer neural networks (multiplayer perceptron, MLP), Kohonen's self-learning networks (SOM), and Hopfield's recursive networks (Tadeusiewicz, 2010, pp. 1–3).

[9] One of the challenges is the fact that the machine learning process, i.e. what happens inside a neural network, is incomprehensible to humans, which is why one of the priorities is to create AI variants whose operation will be fully clear to human operators, which is a fundamental condition for building trust in and security of systems using this technology. For this reason, the US Defense Advanced Research Projects Agency (DARPA) is implementing the Explainable Artificial Intelligence methods (see Gunning, 2017).

[10] The neural network is made up of three basic types of artificial neurons: neurons forming the input layer, neurons forming the hidden layer, and neurons forming the output layer. For example, if a neural network learns to recognize an image, then the pixels that make up the digital image would be input to the external neural network.

networks, which can be accomplished in several ways[11], including from a teacher (*supervised learning*) or through the process of self-learning (*unsupervised learning*). In the first case, the teacher is a program that, based on a properly prepared data set[12], teaches the network by repeatedly indicating the relationship between data and the correct solution (identification of a category of objects, e.g. a type of combat vehicle). The result is the network's ability to properly perform tasks relative to data that was not a direct learning subject (e.g. detection of a given type of combat vehicle at different times of the day and in different atmospheric conditions). Learning without a teacher involves providing a network with data but without indicating expected answers, as a result of which the network can group data into various categories and indicate correlations between data by itself. In both cases, the key to the learning process is to provide a sufficiently large number of examples (e.g. millions of photos)[13] and sufficiently large computing power for the learning process. The approaches described above can be ordered into successive and overlapping development and use phases of this technology. In this context Kai-Fu Lee distinguishes four waves. The first involves the use of AI in the Internet (e.g. content search algorithms, creating purchase recommendations), the second in business (e.g. automated transactions on the stock exchange), the third is related to the use of AI to recognize the physical world (e.g. face recognition), and the fourth wave has enabled machine autonomy (e.g. autonomous cars) (Lee, 2018, pp. 104–139). The aim of implementing them is to support the creation of more efficient business models and ultimately to improve the overall output of a company and the state's economy in general. In the case of state actors, estimates suggest that the positive impact of AI on the global economy can bring growth of up to $10.7 trillion by 2030 and will be

[11] In addition to the ways cited, methods also used include reinforcement learning, which uses the feedback from the environment in the form of punishment or reward, and the generative adversarial network, i.e. the use of two neural networks which are to learn based on a common data set; one independently e.g. creates a false image of a human face and the other tries to determine whether this image is authentic. With each attempt each network learns to generate false objects and recognise counterfeits (Scharre & Horowitz, 2018, pp. 5–6).

[12] For example, object recognition is based on correctly describing the material used for learning, e.g. photos. With a sufficiently large number of examples, the machine is able to learn to identify a given object.

[13] Just as coal was once a key raw material for steam engines and oil for internal combustion engines, data will be a key raw material for AI (Scharre & Horowitz, 2018, p. 3).

particularly noticeable in China and the US – 70% of the forecast increase (26.1% in China and 14.5% in the US) (Gilham, et al., 2018, p. 3).

The impact of AI on international relations will not be restricted only to economy but will have particular influence on "hard" international security. AI technology is not a weapon in itself, but it does have a difficult-to-assess trigger potential (enabling technology) in many other areas that are crucial for both the economic and military power of states (Horowitz, 2018, p. 6). A legitimate analogy that facilitates thinking about the effects of AI implementation may be the emergence and popularization of electricity, a technology that has transformed almost all spheres of life (Ng, 2017). In this context, it is worth recalling the words of Kevin Kelly, the founder of the *Wired* magazine, who said that AI "will revive objects, just as electricity did it more than a century ago. Everything previously electrified will now become cognitized" (Kelly, 2014). In turn, considering the fact that the AI will force the states to redefine their strategic calculations, Kenneth Payne points to the analogy between this technology and the invention and proliferation of nuclear weapons (Payne, 2018, pp. 15–30). In other words, AI technology can be one of the leading forces influencing the stability and thus the transformation of the power structure in the international system. The impact of AI results from four features of this technology that are important from the international perspective.

First, owing to the implementation of AI, many of the existing solutions will gain new capabilities[14], which is associated with the ability of this technology to multiply force (**force multiplier**). The use of AI on a large scale is to contribute to the rapid growth of the potential of the entity that will implement it effectively. In terms of security, AI will enhance and modify many aspects of combat operations (from logistics and reconnaissance to weapon design). These changes will be cumulative and will lead to qualitative transformation at some point. The key is, however, that systems using AI will have an advantage over traditional solutions, mainly due to the shortened response and action time. This fact gives AI a significant superiority over people and is the reason why decisions related to military operations can be automated at both strategic and tactical level. The increasing speed of action on the battlefield (in each of the domains[15]) will require

[14] E.g. an ordinary lorry supplemented with a set of appropriate sensors and a computer enabling the vehicle to move without a man behind the wheel (Sydney, 2018).

[15] So, in the air, on land, on and under water, in space and in cyberspace.

faster reactions[16], which means that the role of autonomous systems (including combat systems) will increase, strengthening trends in reducing human presence on the battlefield (depopulation of the battlefield and dehumanization of warfare). In addition, predictable behavior on the future battlefield will mean imminent death, while unpredictability will clearly increase the chance of surviving and completing the task.

What is more, in cyberspace autonomy is one of the key elements of both offensive and defensive activities, which can be illustrated by the use of the Stuxnet virus, which autonomously conducted activities aimed at i.a. changing the mode of operation of Iranian devices responsible for the uranium enriching centrifuges in such a way as to physically damage them (Scharre, 2018, p. 193). This corresponds with an argument made by an offensive realist John Mearsheimer at the beginning of the 20$^{th}$ century: he claimed that war should still be treated by nation-states as a real "tool" that can be used to increase their share of world power (Mearsheimer, 2001). The argument is especially relevant in the context of the future of AI implementation, when military actions will probably be conducted simultaneously in the real world as well as in the cyber domain by autonomous systems. In this context, it should be noted that the implementation of AI technologies is accompanied by severe ethical and legal doubts as well as related to arms control. Currently, there is still no worldwide consensus on the admissibility of the use of autonomous weapon systems on the battlefield. Moreover, futurists point to a scenario in which the most advanced version (de facto a general AI) theoretically may initiate a process called the mechanism of recursive self-improvement (see Yampolskiy, 2015). This concept assumes that when a self-learning AI is invented, it will initiate a process of constantly enhancing its own abilities or the capabilities of the state or non-state actors that manage to create such technology.

AI technology is being developed both in countries with liberal democratic systems as well as authoritarian states (see Harari, 2018; Horowitz, 2018). And as Peter Liberman shows in his seminal book, new communication technologies may improve the output of the economy but, contrary to liberal vision, those technologies may also be adopted in a more Orwellian style by non-democratic governments to strengthen and secure their political position (Liberman, 1996, p. 28). China's *Social Ranking System* (SRS) may serve as an example illustrating the implementation of solutions that may provide new opportunities for

[16] Gen. John R. Allen and Amir Husain referred to the next generation war with the militant use of AI on a massive scale as hyper war (Allen & Hussain, 2017).

economic growth in a country with an undemocratic system. The SRS is based on monitoring citizens' activity and awarding them points, and a sufficiently high result is necessary to e.g. use air or rail connections (Botsman, 2017, pp. 150–60, 168–170). Although the program's goal is to influence the level of social trust, it can also result in providing data that allows more efficient functioning of existing business models and creating new ones.

The force multiplier feature of this technology is associated with the second aspect of this technology. State elites may begin to perceive the role of AI in a unique way, different from other technologies, so that in the eyes of many countries, work on its development may resemble a race, driven by the belief that whoever is the first to implement this technology in its economy and/or armed forces, they will achieve a strategic advantage over other entities (***first mover advantage***)[17]. This in turn may be conducive to taking preventive measures by states, aimed at limiting the pace of development of other entities. An example of such action may be the US placing microprocessors on the list of goods banned from sale to China (Feng & Hilie, 2018) as well as sanctions targeted at Chinese high technology sector companies (Kozieł, 2019).

The problem is also how to estimate the potential of the country implementing this technology – AI cannot be quantified. It does not resemble known physical weapon systems such as tanks, aircraft carriers or intercontinental ballistic missiles. To estimate the power of a given army, until now it was enough to count how many copies of a given type of weaponry it had. In the case of AI, such a comparison can be complicated, and thus attempts to create any arms control regime in this respect will be extremely difficult, if possible at all. Also, whose AI solutions are better can be seen only when the systems using this technology are confronted. As a result, it is challenging to classify AI as a technology that will support stabilisation of international order (see Scharre, 2018, pp. 26–33). Robert Keohane and Joseph Nye are right when they notice that the "information technology has some effects on the use of force that benefit the small and some that favor the already powerful (…). Many of the relevant technologies

[17] At the same time, it should be emphasised that the invention of a given technology does not automatically mean that it will be used in an optimal way; for example, in the 19th century all countries had access to rail, firearms and telegraph, but it was only Prussia that created a coherent strategy for using all these inventions and translated them into military successes. A similar case was the tank, invented in Great Britain and France in the first years of World War I, but first used effectively on a large scale by the Third Reich during World War II.

are available in commercial markets, and weaker states can be expected to have many of them" (Keohane & Nye, 2012, p. 218). That is the reason why nation states are putting an effort into developing AI technology. By mid-2018, twenty-four countries, as well as the European Commission and eight Nordic and Baltic states (NB8), adopted AI development strategies (Dutton 2018; cf. Dutton 2018b). China planned to create an AI-based market worth 20.5 billion dollars by 2030, with R&D spending in this area increasing from $40.8 million to $412 million between 2000 and 2016. In 2016, the US allocated $1.2 billion to develop this technology (of which $600 million was the budget of the US Department of Defense), while in the same year American companies invested in the development of AI between $20 and 30 billion (Fundacja Digitalpoland, 2018, pp. 47–48, 56, 35).

Thirdly, this is a **dual-use technology** which is being developed by both the private entities[18] as well as public ones from the economic and military sphere of the state. Transnational corporations are the main driving forces behind the development of this technology. That is why the use of AI technology, e.g. in the process of image recognition or decision-making, blurs the border between civil and military applications. Moreover, AI is largely developed in an open manner, mainly by private and academic entities, focused on profit and attracting investors. Openness manifests itself e.g. in that the discoveries in this field are often published in scientific journals and are the subject of a global academic debate, so such information easily penetrates the mass media sphere. As a software-based technology, AI is largely characterised by wide access to *open source* solutions that may find military use (see Léveillé, 2019); moreover, state actors (e.g. China) use non-illegal (*extra-legal transfers*) methods of acquisition and transfer of technological knowledge to the business entities they support[19]. In the above context, the fundamental dilemma is the extent to which AI solutions developed in the private sector may be used – contrary to their original purpose – to cause harm to someone (*Malicious use of AI*) (Pohler, et al., 2018, p. 3) and whether they can be used in the military sphere to achieve a multiplier effect. An example illustrating how real the latter possibility may be is the Maven project, developed in cooperation between the US Department of Defense (US

[18] The leaders include American entities: Google, Apple, Facebook and Amazon ("GAFA") and Chinese entities: Baidu, Alibaba and Tencent ("BAT").

[19] Such instruments include exchanges of scientists, organization of scientific competitions, and establishment of joint science and research centres (see Hannas & Hannas, 2019, pp. 3–21).

DOD) and Google. Its goal was to use AI to support intelligence activities by automating the process of identifying targets in video materials collected and sent e.g. by unmanned vehicles. The project used the TensorFlow library made available as free access (Rickli, 2019, pp. 91–92).

The fourth feature is the disruptive nature of the AI. In history, technological breakthroughs (e.g. firearms) often created a definite advantage for a small group of countries, but as Andrew F. Krepnevich notes, this advantage did not last long, and since the Napoleonic times this period has been shortening more and more: "armed forces, if they want to draw from the advantages of access to new technology must be quickly used before the major rivals copy or compensate for the advantage" (Krepinevich, 1994, p. 37). Moreover, AI seems to be a technology prone to proliferation. To predict the speed of diffusion of technological innovations, Daniel W. Drezner used classification consisting of two pairs of variables. The first set focuses on fixed costs needed to develop a particular technology, and the second takes into consideration whether technology is developed by public or private entities. A combination of these variables allows constructing a 2x2 matrix (see Table 1). AI is a technology with relatively low fixed costs as private corporations play a dominant role in its development. A pace of AI proliferation may be very rapid because, as Drezner stated, "The more that technology approaches the general purpose category, the more quickly it will diffuse across the globe. The lower the fixed costs – whether material, organizational, or societal in nature – the more rapidly a technology should diffuse from leader to laggards" (Drezner, 2019, p. 7).

**Table 1.** A typology of technological innovation

| | Public sector dominance | Private sector dominance |
|---|---|---|
| High fixed costs | Prestige tech<br>e.g. nuclear weapons, manned space exploration, supersonic transport planes, | Strategic tech<br>e.g. 5G networks |
| Low fixed costs | Public tech<br>e.g. Public health innovation like vaccines | General purpose tech<br>e.g. drones, Artificial Intelligence |

Source: Drezner, 2019, p. 7.

It should be noted here that, while the technologies previously developed in strict secrecy (e.g., radar detection (stealth)) were of physical nature –the process of their duplication (both legal and illegal) required involvement of significant resources – computer-based technologies are more easily replicable. What is more, inventions were repeatedly developed in various places at the same time, which meant that the gap between the armed forces that were the first to use a given weapon system and other actors was reduced even faster (submarines, tanks, nuclear weapons). In addition, the availability of commercial solutions seems to have contributed, as never before, to a situation in which the pace of some information technology development is accelerating, causing the technology gap between countries and enterprises to be reduced at an even faster rate.

All four features make AI a technology particularly important for international relations, mainly because they may influence the potential and capabilities that are at states' disposal, and together they may generate transformative impulse for the international system.

## 3. Conclusion: *How* may AI influence international relations?

The importance of AI for international relations may be reaffirmed by Charles Weiss' model. In order to signal the possible areas of the impact of AI technology on (the system of) international relations, the author will use the theoretical conceptualizations of Charles Weiss; as one of the few theorists who have attempted to systematise the impact of new technologies on global politics, he indicated a total of eight connections binding these two (Weiss, 2005, pp. 297–299)[20]. First, technology directly affects international relations because it enables creation of new things that have a direct impact on world politics (e.g. the invention of nuclear weapons has resulted in changes in the way of constructing a balance of power). Secondly, this influence is also manifested in the diffusion of new technology – the speed at which it becomes available to other actors, affecting the distribution of power in the international system. Thirdly, technology affects international relations because it is an important element of competition between countries (e.g. in the form of an arms race). Fourthly, technology has an impact on international relations by diversifying the capabilities that states have in effective technology management, which translates into the economic position of a given state. In addition, international relations directly affect technology

[20] This author indicates a total of six mutual relations connecting the three components indicated by him: international relations, exact sciences (i.e. knowledge of the world ordered by scientific method) and technologies (i.e. application of scientific knowledge). The argument cites the characteristics of interrelationships between technology and international relations.

through the attitude of public opinion towards various technologies, which may influence the level of financing they receive. Secondly, foreign policy objectives directly translate into funded research programs. Thirdly, international relations affect the level and intensity of inter-state migration of scientists and the level of freedom in conducting research (see Wojciuk, 2016). Fourthly, this impact is visible in the agreements protecting intellectual property and indirectly through the norms of international law. These interactions were collected by the author in the table below (see Table 2). The strength of the predicted effect of each of the features on the particular elements is described on a scale from very strong (+++), to medium (++), to moderate (+).

**Table 2.** Impact of AI on relationships in the international system

| | **AI features** | | | |
|---|---|---|---|---|
| **Influence of technology on international relations according to Charles Weiss** | Multiplier character | Work on its development may resemble an arms race | Dual-use technology | Disruptive nature of this technology |
| Creation of new artefacts that have a direct impact on world politics | +++ | ++ | ++ | +++ |
| New technology diffusion | + | +++ | +++ | +++ |
| An important element of competition between countries | +++ | +++ | + | + |
| Capacity differentiation, which translates into the economic position of the state | +++ | +++ | ++ | ++ |
| **Influence of international relations on technology according to Charles Weiss** | | | | |
| Attitude of the public opinion towards various technologies influences their financing level | +++ | +++ | ++ | +++ |
| Foreign policy goals directly translate into funded research programs | +++ | +++ | + | ++ |
| International relations affect the level and intensity of inter-state migration of scientists and the level of freedom of research introduction | + | + | ++ | +++ |
| Agreements protect intellectual property and international law standards | ++ | ++ | +++ | ++ |

Source: author's own study.

AI significance stems from the fact that it plays an important role in all interactions indicated in the model between this technology and international relations. However, what is particularly significant from this perspective is the effects of the multiplier nature of this technology, which has a bearing on the diversification of the capacity and economic position of the state and thus its military power and scope of influence on the international system. This does not create favourable conditions for promoting peace and stability; as Joseph Nye and David Welch pointed out, "When the prevailing military technology is believed to favor the offense, decision makers feel pressure to strike the first blow. When it is believed to favor the defense, they do not" (Nye & Welch, 2014, p. 57). Moreover, non-state entities, including transnational corporations often develop dual-use projects, thereby facilitating the proliferation of this technology, and thus they play a special role in turning civil AI technology into military capabilities. This may also express more significant support for offensive activities (Hoadley & Lucas, 2018, p. 41), including in particular a new type of kinetic activity (e.g. through cyberspace) (Spiegeleire, Maas & Sweijs, 2017, p. 61). Bearing this in mind, Henry Kissinger (together with the former chairman of Alphabet and the dean of MIT) expressed the fear that in the future in which AI will co-develop weapon systems and the tactics for using them on the battlefield, it will not be possible to uphold the concepts of deterrence and balance of power – the foundations of peaceful coexistence of states (Kissinger, et al., 2018). Since, unlike previous weapon systems, the potential of AI cannot be measured in a way other than by direct confrontation, countries will be even more likely to hide the capabilities of their solutions that use this technology. Each of these facts is conducive to the emergence of the mechanism of a new arms race, at the end of which may also lie a transformation of the current international system.

Particular attention should be drawn to the question of how the development of AI will affect the international balance of power and the contemporary US-China rivalry. In this context an observation made by John Mearsheimer seems to be very accurate – "great powers always prefer to be the first to develop new technologies; they have to make sure that their opponents do not beat them to the punch and gain the advantage for themselves" (Mearsheimer, 2001, p. 232). US and China are at the beginning of a technological race for dominance in AI and, according to the Centre For Data Innovation report, out of six key fields for AI development in 2019, the US was a leader in four (access to talented employees, research, development, computer equipment), and China in two (implementation, access to data) (Castro, et al., 2019, p. 3). In this context, Kai-Fu Lee is convinced that Chinese technology companies will gradually gain and increase advantage over their American counterparts (Lee, 2018, passim). This is due to the fact that the Chinese state directly interferes in the market supporting key enterprises. What is more, the current level of development of this technology requires not so much innovation (the strength of the US), but numerous human resources capable of implementing this technology (China's advantage). In addition, Chinese companies compete in a less restrictive environment to protect intellectual property and access to data; they are forced to compete even more than American entities. It seems likely that Chinese AI solutions will be implemented faster than those from the US, which can give China an upper hand in the future.

The rise of AI enables a future scenario for the transformation of the global order, in which the world will be divided into two separate, internally uniform blocs, and this division will embrace political as well as cultural (e.g. attitude toward the role of autonomous systems) and technological issues. The core of the first camp will be formed around the US and its closest allies (Australia, Canada, Japan, and probably most of the EU countries), while the second camp will be populated by states willing to accept China's political model and technological solutions developed by Chinese companies (ranging from weapon systems to 5G communication). The rest of the world will be under constant economic and political pressure from both camps. In this scenario, the economic potential of the countries that effectively adopt AI will be multiplied; however, in terms of potential the new world order will resemble the current one with two major differences – there will be two easily distinguishable camps and, thanks to adoption of AI, the gap between the most developed/advanced countries and the rest will develop faster, and will grow wider than ever before.

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